FORM PTO-1390(Modified) (REV 11-98)	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		0112740-143
		U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/763444

INTERNATIONAL APPLICATION NO. PCT/DE99/02649	INTERNATIONAL FILING DATE 24 August 1999	PRIORITY DATE CLAIMED 24 August 1998

TITLE OF INVENTION
A METHOD FOR TRANSMITTING AN ATM-ORIENTED CELL STREAM VIA AT LEAST TWO VIRTUAL CONNECTIONS IN AN ATM COMMUNICATIONS NETWORK

APPLICANT(S) FOR DO/EO/US
Siegfried Huber et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))

    a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).

    b. ☒ has been transmitted by the International Bureau.

    c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ☒ A copy of the International Search Report (PCT/ISA/210).

8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))

    a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).

    b. ☐ have been transmitted by the International Bureau.

    c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.

    d. ☒ have not been made and will not be made.

9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).

11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).

12. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

15. ☒ A **FIRST** preliminary amendment.

16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.

17. ☐ A substitute specification.

18. ☐ A change of power of attorney and/or address letter.

19. ☒ Certificate of Mailing by Express Mail

20. ☒ Other items or information:

Submission of Drawings Fig.ure 1 on one sheet

PCTUS1/REV03

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/763444	INTERNATIONAL APPLICATION NO. PCT/DE99/02649	ATTORNEY'S DOCKET NUMBER 0112740-143

21. The following fees are submitted:.	CALCULATIONS PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000.00

☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO $860.00

☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =	$860.00	

Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	$0.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	5 - 20 =	0	x $18.00	$0.00	
Independent claims	1 - 3 =	0	x $80.00	$0.00	
Multiple Dependent Claims (check if applicable) .			☐	$0.00	

TOTAL OF ABOVE CALCULATIONS =	$860.00	

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable) .	☐	$0.00	

SUBTOTAL =	$860.00	

Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +	$0.00	

TOTAL NATIONAL FEE =	$860.00	

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).	☐	$0.00	

TOTAL FEES ENCLOSED =	$860.00	

	Amount to be: refunded	$
	charged	$

☒ A check in the amount of **$860.00**   to cover the above fees is enclosed.

☐ Please charge my Deposit Account No.   in the amount of   to cover the above fees.
    A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment
   to Deposit Account No.   **02-1818**   A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690-1135

SIGNATURE

William E. Vaughan
NAME

39,056
REGISTRATION NUMBER

February 21, 2001
DATE

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANTS: Siegfried Huber et al.   DOCKET NO: 112740-143

SERIAL NO: GROUP ART UNIT:

                                             EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE99/02649

INTERNATIONAL FILING DATE: 24 August 1999

INVENTION: A METHOD FOR TRANSMITTING AN ATM-ORIENTED
              CELL STREAM VIA AT LEAST TWO VIRTUAL
              CONNECTIONS IN AN ATM COMMUNICATIONS
              NETWORK

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

     Please amend the above-identified International Application before entry
into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C.
§371 as follows:

In The Specification:

     On page 1, cancel lines 1-5 and substitute the following therefor:

--**S P E C I F I C A T I O N**

TITLE

**A METHOD FOR TRANSMITTING AN ATM-ORIENTED CELL
STREAM VIA AT LEAST TWO VIRTUAL CONNECTIONS IN AN ATM
COMMUNICATIONS NETWORK**

BACKGROUND OF THE INVENTION

Field of the Invention

-1-

The present invention relates, generally, to an ATM-oriented cell stream which is transmitted via an ATM communications network in which at least two virtual connections are provided and, more particularly, to such a method wherein the ATM-oriented cell stream is distributed between the at least two virtual connections and in which, at least at times, synchronization cells are regularly inserted into the virtual connections.

Description of the Prior Art--.

On page 1, line 7, cancel "the".

On page 1, lines 9-10, cancel "by means of" and substitute therefor --via--.

On page 1, line 10, cancel the "," and substitute therefor a --;--.

On page 1, line 10, cancel "to say" and substitute therefor a --,--.

On page 1, line 15, cancel "is".

On page 1, line 15, insert --is-- after "also".

On page 1, line 31, cancel "are" and substitute therefor --being--.

On page 2, line 11, cancel "means of".

On page 2, line 12, cancel "comprise" and substitute therefor --include--.

On page 2, line 18, cancel the "-" and substitute therefor a --;--.

On page 2, line 18, cancel "to say" and substitute therefor a --,--.

On page 2, line 20, cancel "- while" and substitute therefor --. However--.

On page 2, line 38, cancel the "-" and substitute therefor a --;--.

On page 2a, line 1, cancel "is" and substitute therefor --being--.

On page 2a, line 2, insert --also-- after "technology".

On page 3, line 1, cancel "also".

On page 3, line 4, cancel "and".

On page 3, line 4, cancel "is" and substitute therefor --being--.

On page 3, line 19, cancel ", which" and substitute therefor --. This--.

On page 3, line 26, cancel the ",".

On page 3, line 34, cancel the "," and substitute therefor a --;--.

On page 3, line 35, insert a --,-- after "example".

On page 4, line 15, cancel the "-" and substitute therefor a --;--.

On page 4, line 15, cancel "is" and substitute therefor --being--.

On page 4, line 30, cancel ", as" and substitute therefor --. As--.

On page 4, line 31, cancel "of which" and substitute therefor a --,--.

On page 5, line 2, cancel "in" after "headers" and substitute therefor --is--.

On page 5, line 10, insert --present-- before "invention".

On page 5, line 10, cancel "based on the object of" and substitute therefor --directed to--.

On page 5, before line 15, insert the following centered heading:

--**SUMMARY OF THE INVENTION**--.

On page 5, line 15, cancel "The" and substitute therefor --A--.

On page 5, line 15, insert --present-- before "invention".

On page 5, line 24, cancel "according to" and substitute therefor --of--.

On page 5, line 24, insert --present-- before "invention".

On page 5, line 28, insert --present-- before "invention".

On page 5, line 29, cancel "mean that" and substitute therefor --allow--.

On page 5, line 29, cancel "is" and substitute therefor --to be--.

On page 5, line 36, cancel the "-" and substitute therefor a --;--.

On page 5, line 36, cancel "to say" and substitute therefor a --,--.

On page 6, line 4, cancel "refinement" and substitute therefor --embodiment--.

On page 6, line 5, insert --present-- before "invention".

On page 6, line 7, cancel "- claim 2".

On page 6, line 13, cancel "refinement" and substitute therefor --development--.

On page 6, line 13, cancel "according to" and substitute therefor --of--.

On page 6, line 14, insert --present-- before "invention".

On page 6, line 15, cancel "- claim 3".

On page 6, line 20, cancel the "-" and substitute therefor a --;--.

On page 6, line 20, insert a --,-- after "example".

On page 6, line 24, cancel "comprises" and substitute therefor --includes--.

On page 6, line 29, cancel "according to" and substitute therefor --of--.

On page 6, line 30, insert --present-- before "invention".

On page 6, line 33, cancel "- claim 4".

On page 7, line 1, insert --further-- before "development".

On page 7, line 1, cancel "according to" and substitute therefor --of--.

On page 7, line 2, insert --present-- before "invention".

On page 7, line 5, cancel "- claim 5".

On page 7, line 10, cancel "According" and substitute therefor --Pursuant--.

On page 7, line 10, cancel "one development" and substitute therefor --another embodiment--.

On page 7, line 11, insert --present-- before "invention".

On page 7, line 13, cancel "- claim 6".

On page 7, line 16, cancel "can".

On page 7, line 16, insert --can-- after "still".

On page 7, line 19, cancel "one" and substitute therefor --yet another--.

On page 7, line 19, cancel "according to" after "method" and substitute therefor --of--.

On page 7, line 20, insert --present-- before "invention".

On page 7, line 22, cancel "- claim 7".

On page 7, line 27, cancel "according to" and substitute therefor --of--.

On page 7, line 28, insert --present-- before "invention".

On page 7, line 31, cancel "- claim 8".

On page 7, after line 36, insert the following paragraph:

--Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Preferred Embodiments and the Drawings.--

On page 8, cancel lines 1-5 and substitute the following therefor:

-4-

--DESCRIPTION OF THE DRAWINGS

Figure 1 shows an exemplary embodiment of the ATM communications network in accordance with the teachings of the present invention in which a number of virtual connections are provided.

5 **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**--.

On page 8, line 6, insert --Referring to Fig. 1,-- before the "(".

On page 8, line 8, cancel "by means of" and substitute therefor --via--.

On page 8, line 9, cancel the "-" and substitute therefor a --;--.

On page 8, line 9, cancel "the figure" and substitute therefor --Fig. 1--.

10 On page 8, line 23, insert --be-- after "can".

On page 8, line 23, cancel "be".

On page 8, line 24, cancel the "-" and substitute therefor a --;--.

On page 8, line 24, cancel "is".

On page 9, line 1, cancel the",".

15 On page 9, line 4, cancel the "-" and substitute therefor a --;--.

On page 9, line 4, cancel "is".

On page 9, line 8, insert --of the present invention shown-- after "embodiment".

On page 10, line 12, cancel the "-" and substitute therefor a --,--.

20 On page 10, line 13, cancel the "-" and substitute therefor a --,--.

On page 10, line 26, cancel the "-" and substitute therefor a --(--.

On page 10, line 27, cancel "corresponds" and substitute therefor --corresponding to--.

On page 10, line 27, cancel "to".

25 On page 10, line 30, cancel the "-" and substitute therefor a --)--.

On page 10a, line 1, cancel "one" and substitute therefor --an alternative--.

On page 10a, line 1, cancel "variant".

On page 10a, line 2, cancel "according to" and substitute therefor --of--.

On page 10a, line 2, insert --present-- before "invention".

On page 10a, line 4, cancel "which" and substitute therefor --with--.

On page 11, line 3, insert --above-- before "example".

On page 11, line 4, cancel "quoted above,".

On page 11, line 9, cancel "comprises" and substitute therefor --includes--.

On page 11, line 14, cancel "may".

On page 11, line 14, insert --may-- after "possibly".

On page 11, line 20, cancel "according to" and substitute therefor --of--.

On page 11, line 23, cancel the "-" and substitute therefor a --;--.

On page 11, line 23, cancel "to say" and substitute therefor a --,--.

On page, after line 29, insert the following paragraph:

--Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.--

On page 14 (last page), cancel lines 1-5, and substitute the following centered heading therefor:

--**ABSTRACT OF THE DISCLOSURE**--.

On page 14, line 7, cancel "The" and substitute therefor --A--.

On page 14, lines 7-8, cancel "according to the invention is used to transmit" and substitute therefor --for transmitting--.

On page 14, line 8, cancel "(zs10)".

On page 14, line 9, cancel "(bs)".

On page 14, line 10, cancel "(KN)".

On page 14, line 11, cancel "(VC11-VC1N)".

On page 14, line 12, cancel "(KN)".

On page 14, line 13, cancel "(zs10)".

On page 14, line 14, cancel "(sz)".

On page 14, line 16, cancel "(VC11-VC1N). A" and substitute therefor --wherein a--.

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On page 14, line 16, cancel "(bs)".

On page 14, line 17, cancel "thus".

On page 14, lines 17-18, cancel "(VC11-VC1N)".

On page 14, cancel line 20.

5   **In the Claims**:

On page 12, cancel line 1, and substitute the following left-hand justified heading therefor:

--**We Claim As Our Invention:**--.

Please cancel claims 1-5, without prejudice, and substitute the following

10   claims therefor:

6.   A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided, the method comprising the steps of:

converting the continuous bit stream to an ATM-oriented cell stream; and

15   transmitting the ATM-oriented cell stream distributed between the at least two virtual connections, wherein synchronization cells are regularly inserted, at least at times, into the at least two virtual connections.

7.   A method for transmitting a continuous bit stream via an ATM

20   communications network in which at least two virtual connections are provided as claimed in claim 6, the method further comprising the step of:

defining the synchronization cells by a synchronization cell identifier in a header part of the ATM cells.

25   8.   A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, wherein the synchronization cells respectively contain a sequence number.

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9.   A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, wherein the ATM-oriented cell stream has a transmission bit rate which is greater than respective maximum transmission bit rates of the two virtual
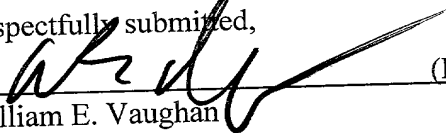
5   connections.

10.   A method for transmitting a continuous bit stream via an ATM communications network in which at least two virtual connections are provided as claimed in claim 6, wherein assembly into one of the original ATM-oriented cell

10   stream and the original continuous bit stream is carried out with the aid of the synchronization cells after transmission via the at least two virtual connections.

REMARKS

The present amendment makes editorial changes and corrects typographical

15   errors in the specification in order to conform the specification to the requirements of the United States Patent practice. No new matter is added thereby. Original claims 1-5 have been canceled in favor of new claims 6-10. Claims 6-10 have been presented solely because the revisions by bracketing and underlining which would have been necessary in claims 1-5 in order to present those claims in accordance with

20   preferred United States Patent practice would have been too extensive, and thus would have been too burdensome. The amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-7 does not constitute an intent on the part of the Applicants to surrender any of the subject

25   matter of claims 1-5.

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Early consideration on the merits is respectfully requested.

Respectfully submitted,

_____ (Reg. No. 39,056)
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5

Description

Method for transmitting an ATM-oriented cell stream via
at least two virtual connections in an ATM
5   communications network

When virtual private networks are being set up, the
information is frequently transmitted between the
switching devices in the virtual private networks by
10   means of fixed connections, that is to say with the aid
of continuous bit streams. The transmitted digital or
digitized information represents, for example, voice,
text, data, characters, graphics, still images or
moving images. In the specialist world, such
15   information is also referred to as user information.

In Europe, fixed connections based on the plesio-
chronous digital hierarchy PDH which provides, for
example, transmission capacitors of 64 Kbit/s,
20   2 Mbit/s, 34 Mbit/s and 140 Mbit/s, are used for bit
streams up to 140 Mbit/s. In the USA, fixed
connections, for example based on hierarchy levels DS1
and DS3, are provided for this purpose, with
transmission capacities of 1.5 Mbit/s and 45 Mbit/s,
25   respectively, or based on the synchronous optical
network SONET, for example 51.84 Mbit/s. For bit
streams at more than 155 Mbit/s, fixed connections are
generally provided on the basis of the synchronous
digital hierarchy SDH which provides, for example,
30   transmission capacities of 155 Mbit/s, 622 Mbit/s or
2.5 Gbit/s; the same hierarchy levels are provided in
the SONET in the USA for more than 155 Mbit/s.

The transmission capacity of the fixed connections
35   which are required to set up a virtual private network
and are normally rented from a network operator depends
on the amount of information to be transmitted. In this
case, owing to the relatively major differences between

the transmission capacities of the hierarchy levels,
optimum matching

between the transmission capacity required and that
provided is frequently impossible.

With the increasing integration of voice and data
5   networks, the present-day PDH, SONET and SDH networks
are increasingly being replaced by networks which are
set up on the basis of the asynchronous transfer mode
ATM.   This   technology   allows   ATM-oriented   fixed
connections   -   so-called   "virtual   connections"   or
10   "permanent virtual connections" - to be set up, via
which information is transmitted by means of so-called
"ATM cells" which each comprise a header part, which is
composed of five octets and is used for control, and an
information part, which is composed of 48 octets and is
15   used for information transmission.

The transmission capacity of a virtual connection is
freely variable - that is to say it is independent of
the   hierarchy   levels   in   the   PDH,   SONET   or   SDH
20   technology - while, owing to the switching of a virtual
connection from the switching devices in an ATM network
to   a   physical   connection,   the   maximum   transmission
capacity of a virtual connection is limited to the
maximum   transmission   capacity   of   the   transmission
25   technology which is used on the physical connections of
the   communications   network   and   with   whose   aid   the
virtual connections are transmitted.

When a network migrates, for example, from SDH to ATM
30   technology, the core area of the network is normally
converted first of all to the ATM technology, while SDH
technology   is   still   used   in   the   periphery   of   the
network. In the process, the previously SDH-oriented
fixed connections must be provided in the core area
35   with the aid of virtual connections. This is normally
done by embedding the continuous bit stream of an SDH-
oriented fixed connection in the information parts of
the ATM cells of a virtual connection - the continuous

bit stream is converted to an ATM-oriented cell stream.
This technology is

also referred to in the specialist world as "transparent" transmission or as the circuit emulation service CES. One known method for this is described in ITU-T Standard I.363.1, and this is known to persons
5 skilled in the art as the ATM Adaptation Layer 1, or as AAL-1.

The cell headers which also need to be transmitted with each ATM cell increase the bit rate of the ATM-oriented
10 cell stream over the bit rate of the continuous bit stream for an SDH-oriented fixed connection. If, for example, the continuous bit stream for an SDH fixed connection has a bit rate of 622 Mbit/s, then, after conversion to an ATM-oriented cell stream, the bit
15 stream has a bit rate of at least 687 Mbit/s. This bit rate is increased further when the AAL-1 method is used since, in this method, at least one octet of further control information is transmitted in the information part of the ATM cells, which results in the bit rate of
20 the ATM-oriented cell stream being increased to at least 701 Mbit/s. If the transmission technology which is used for the physical connections of a communications network is now limited, for example, to a maximum transmission capacity of 622 Mbit/s, a
25 problem occurs in that the ATM-oriented cell stream cannot be transmitted using one virtual connection, since the transmission capacity of the transmission technology is not sufficient for the physical connections.
30
It is known for the existing transmission technology to be replaced by a transmission technology using a transmission capacity which is sufficient for transmission of the ATM-oriented cell stream, for
35 example an SDH technology with a transmission capacity of the next higher hierarchy level. In this case, additional investment is required to upgrade the transmission technology and, since there is a relatively major step-function change in the

transmission capacity between the hierarchy levels,
transmission capacity remains unused. In principle,
this substitution is impossible unless transmission
technology

having a greater transmission capacity is available; for example, at the moment, no SDH system with a 2.5 Gbit/s transmission capacity for each physical connection is yet commercially available.

European Patent Application EP 0 576 856 A3 discloses a method in which a continuous bit stream, which requires a higher transmission capacity than that of the virtual connections in an ATM communications network, is distributed between at least two virtual connections. The continuous bit stream is subdivided into bit groups whose numbers of bits plus a defined number of control bits corresponds to the total number of bits which can be transmitted as user information in the information part of an ATM cell - the continuous bit stream is converted to an ATM-oriented cell stream. In successive control cycles, at least two bit groups are in each case taken from the continuous bit stream and, with the addition of a sequentially changing bit group sequence number, are inserted into the information part of ATM cells. These ATM cells are transmitted separately via the at least two virtual connections, and are then assembled again, as a function of the bit group sequence number, to form the original bit stream. In this method, the continuous bit stream is always subdivided into bit groups. If the continuous bit stream already represents an ATM cell stream, not only the information parts but also the cell headers of this ATM cell stream are transmitted as user information in the information part of the newly formed ATM cells, as a result of which two cell headers are transmitted, and this is associated with a reduction of the throughput rate of the actual user information.

European Patent 0584398 discloses a method in which an ATM-oriented cell stream takes place over at least two virtual connections as a development of the method described in European Patent Application

EP 0 576 856 A3. In this case, the duplicated transmission of the cell headers in avoided in that the ATM cell stream contained in the continuous bit stream is depacketized before the subdivision into bit groups.

5   This involves increased control complexity. The subdivision of the continuous bit stream into bit groups, which is always provided in European Patent Application EP 0 576 856 A3, takes place unchanged.

10   The invention is thus based on the object of improving the transmission of an ATM-oriented cell stream in an ATM communications network via at least two virtual connections.

15   The major aspect of the invention is that an ATM-oriented cell stream is transmitted via an ATM communications network in which at least two virtual connections are provided in the ATM communications network, in which the ATM-oriented cell stream is

20   distributed between the at least two virtual connections, and in which, at least at times, synchronization cells are regularly inserted into the virtual connections. A major advantage of the method according to the invention is that the information

25   parts of the cells of the ATM-oriented cell stream are supplied unchanged to the virtual connections. The information parts may thus contain any desired user data. A further advantage of the invention is that the synchronization cells mean that it is possible to

30   determine the propagation time differences between the ATM cells transmitted via the virtual connections. When an appropriately large number of ATM cells which have been transmitted via the virtual connections have been stored in the receiving device, it is thus possible to

35   obtain the assembly of the original ATM-oriented cell stream - that is to say with the original sequence of the ATM cells. In addition, the distribution process advantageously results in the load from the transmission capacity required for transmission of the

ATM-oriented cell stream being distributed between the
physical connections, provided the virtual

connections are routed via different physical connections.

One advantageous refinement of the method according to the invention results in the synchronization cells being defined by a synchronization cell identifier in the header part of ATM cells - claim 2. This is linked to the advantage that any desired bit combination can be transmitted in the information parts of the transmitted ATM cells since there is no need to define any specific bit combination as a synchronization cell.

A further refinement of the method according to the invention provides for the synchronization cells to contain a sequence number - claim 3. This is linked to the advantage that propagation time differences of any magnitude can be determined if a sufficiently large number of bits are used for transmission of the sequence numbers in the information part of the synchronization cells - for example 32 bits. If, for example, a synchronization cell is introduced after each 32 user cells and the transmission takes place at a bit rate of 622 Mbit/s, then, if the sequence number comprises nine bits, it is possible to determine a difference of about 1 000 km between the lengths of the physical connections via which the virtual connections are transmitted.

According to one variant of the method according to the invention, the ATM-oriented cell stream has a transmission bit rate which is greater than the respective maximum transmission bit rates of the virtual connections - claim 4. This advantageously makes it possible to transmit the ATM-oriented cell stream if, for example for technical reasons, it is impossible to increase the transmission bit rates of the virtual connections, or this is not done for financial reasons.

One development of the method according to the invention provides for assembly into the original ATM-oriented cell stream to be carried out with the aid of the synchronization cells after transmission via the

5   virtual connections - claim 5. This advantageously ensures that the sequence of the cells in the ATM-oriented cell stream is reproduced after transmission via the virtual connections.

10   According to one development of the method according to the invention, a continuous bit stream is converted to the ATM-oriented cell stream and is transmitted with the aid of the ATM-oriented cell stream - claim 6. This has the advantage that, for example if an SDH-oriented

15   network is being replaced by an ATM-oriented network, already existing fixed connections can still be carried, unchanged, via the new ATM network.

According to one variant of the method according to the

20   invention, the continuous bit stream is converted to the ATM-oriented cell stream in accordance with ITU-T Standard I.363.1 - claim 7. This means that it is already possible to transmit continuous bit streams converted in accordance with the Standard via the

25   virtual connections.

One alternative form of the method according to the invention provides for assembly into the original continuous bit stream to be carried out with the aid of

30   the synchronization cells after transmission via the virtual connections - claim 8. Appropriate storage of the ATM cells transmitted via the virtual connections, and appropriate access to this memory, allows the original bit stream to be assembled without any

35   previous assembly of the original ATM-oriented cell stream.

The method according to the invention will be explained
in the following text with reference to a figure. By
way of example, the figure shows an ATM communications
network (KN) in which a number of virtual connections
5   (VC11-VC1N) are provided. A number of switching devices
(VE1-VE6) are used for switching the ATM cells
transmitted in the virtual connections and are
connected to one another by means of physical
connections - indicated indirectly in the figure by the
10   virtual connections (VC11-VC1N). The various routes
through the ATM communications network (KN) indicate
that the virtual connections (VC11-VC1N) are routed via
different physical connections. The virtual connections
(VC11-VC1N) are routed between two matching units
15   (VIMA1-VIMA2) which are connected to the switching
devices (VE1-VE6), with the first matching unit (VIMA1)
being used for the distribution of an ATM-oriented cell
stream (zs10) for transmission via the virtual
connections (VC11-VC1N), and the second matching unit
20   (VIMA2) being used for a combination of the original
ATM-oriented cell stream (zs10) after transmission via
the virtual connections (VC11-VC1N). The matching units
(VIMA1-VIMA2) can alternatively be integrated in the
switching devices (VE1-VE6) - as is indicated by the
25   dashed illustration of the switching devices VE5 and
VE6. Two conversion units (CES1-CES2) are provided for
converting a continuous bit stream (bs) transmitted,
for example, via a fixed connection. The first
conversion unit (CES1) is connected to the first
30   matching unit (VIMA1) and converts the continuous bit
stream (bs) to an ATM-oriented cell stream (zs10),
which may be transmitted in a further virtual
connection (VC10). The second conversion unit (CES2) is
connected to the second matching unit (VIMA2) and
35   converts the ATM-oriented cell stream (zs10), which may
be transmitted in the further virtual connection
(VC10), to the original continuous bit stream (bs).
Optionally, the second conversion device (CES2) may *be*
dispensed

with, if the assembly of the original continuous bit stream (bs) takes place without assembly of the original ATM-oriented cell stream (zs10) in the second matching unit (VIMA2) - as is illustrated by the dashed
5   representation of the further arrow, which is denoted bs.

For the exemplary embodiment, it is assumed that the first conversion unit (CES1) is supplied with a
10 continuous bit stream (bs) which it converts to an ATM-oriented cell stream (zs10). One example of conversion is described in International Standard I.363.1 from the ITU-T. The ATM-oriented cell stream (zs10) is now supplied to the first matching unit (VIMA1) and is
15 distributed from there between the connected virtual connections. If the ATM-oriented cell stream (zs10) is transmitted via the further virtual connection (VC10), the connection identifier of the further virtual connection (VC10), which is transmitted in the header
20 part of a supplied ATM cell (z) in accordance with the ATM Standard, is replaced by the connection identifier of that virtual connection to which the supplied ATM cell (z) is distributed by the matching unit (VIMA1). The ATM-oriented cell stream (zs10) distributed in this
25 way is then transmitted via the virtual connections (VC11-VC1N) in the form of further ATM-oriented cell streams (zs11-zs1N) via the ATM communications network (KN) to the second matching unit (VIMA2).

30 Owing to the different routes via the switching devices (VE1-VE6), different propagation times may occur for the ATM cells transmitted in the virtual connections. Synchronization cells (zs) are regularly inserted into the virtual connections in the first matching unit
35 (VIMA1) in order to determine the propagation time differences, and are defined by a synchronization cell identifier (szk) in the header part of ATM cells. Such insertion is required, for example, when setting up the virtual connections (VC11

-VC1N) in order to determine the propagation time
differences for the first time. Synchronization cells
(sz) also need to be inserted at times if synchronizm
is lost. When synchronizm exists, it is possible to
dispense with the transmission of the synchronization
cells (sz), thus increasing the throughput rate of the
virtual connections (VC11-VC1N). If the propagation
time differences are relatively long, it is possible
for synchronization cells (sz) which have been inserted
at the same time into the virtual connections (VC11-
VC1N) to be received in the second matching unit
(VIMA2) shifted with respect to one another - as a
result of very different propagation times - to such an
extent that it is no longer possible to associate the
synchronization cells (sz) with one another. In this
case, synchronization cells (sz) which have been
inserted into the virtual connections (VC11-VC1N) at
the same time can be identified with the aid of an
identical sequence number (sn), so that it is possible
to associate the synchronization cells (sz) with one
another in the second matching unit (VIMA2). If, for
example, the ATM cells are transmitted at a bit rate of
622 Mbit/s, approximately 1 666 ATM cells are
transmitted per millisecond. If the propagation time
difference of the ATM cells transmitted via the virtual
connections (VC11-VC1N) is, for example, 5 ms - this
corresponds approximately to a length difference of
1000 km between the physical connections via which the
virtual connections (VC11-VC1N) are carried and to
transmission of 8,333 ATM cells - and if a
synchronization cell (sz) is inserted after each 32 ATM
cells, then two synchronization cells (sz) which have
been inserted into the virtual connections (VC11-VC1N)
at the same time are received in the second matching
unit (VIMA2) shifted by up to 260 synchronization cells
(sz) with respect to one another. A sequence number
(sn) of at least nine bits is therefore required for
unique identification of the two synchronization cells
(sz).

According to one embodiment variant of the method
according to the invention, the original ATM-oriented
cell stream (zs10) is now assembled in the second
matching unit (VIMA2) which the aid of the
5   synchronization cells (sz). In this case, the received

ATM cells have to be temporarily stored in a memory device (SP) in order to compensate for the propagation time differences. In the case of the example of transmission at a bit rate of 622 Mbit/s, quoted above,

5 and with a maximum propagation time difference between the ATM cells of 5 ms, it is necessary to store approximately 66 664 ATM cells if transmission takes place via, for example, eight virtual connections (VC11-VC1N), so that the memory device (SP) comprises

10 approximately 4 Mbytes. The original ATM-oriented cell stream (zs10) is now taken from the second matching unit (VIMA2) and is supplied to the second conversion unit (CES2), in which case the original ATM-oriented cell stream (zs10) may possibly be contained in the

15 further virtual connections (VC10). Finally, the original ATM-oriented cell stream (zs10) is converted to the original continuous bit stream (bs) in the second conversion unit (CES2).

20 In a further variant of the method according to the invention, the original continuous bit stream (bs) is assembled in the second matching unit (VIMA2) with the aid of the synchronization cells - that is to say without the original ATM-oriented cell stream (zs10)

25 being assembled. In this case, the transmitted bit stream parts are taken from the information parts of the ATM cells which have been temporarily stored in the memory device (SP), and are assembled to form the original continuous bit stream (bs).

Patent Claims

1.   A method for transmitting an ATM-oriented cell
      stream (zs10) via an ATM communications network
5   (KN),
      in which at least two virtual connections (VC11-
      VC1N) are provided in the ATM communications
      network (KN),
      in which the ATM-oriented cell stream (zs10) is
10   distributed between the at least two virtual
      connections (VC11-VC1N), and
      in which, at least at times, synchronization cells
      (sz) are regularly inserted into the virtual
      connections (VC11-VC1N).

15

2.   The method as claimed in claim 1,
      characterized
      in that the synchronization cells (sz) are defined
      by a synchronization cell identifier (szk) in the
20   header part of ATM cells.

3.   The method as claimed in one of claims 1 or 2,
      characterized
      in that the synchronization cells (sz) contain a
25   sequence number (sn).

4.   The method as claimed in one of the preceding
      claims,
      characterized
30   in that the ATM-oriented cell stream (zs10) has a
      transmission bit rate which is greater than the
      respective maximum transmission bit rates of the
      virtual connections (VC11-VC1N).

35 5.   The method as claimed in one of the preceding
      claims,
      characterized
      in that assembly into the original ATM-oriented
      cell stream (zs10) is carried out with the aid of

the synchronization cells (sz) after transmission
via the virtual connections (VC11-VC1N).

6. The method as claimed in one of the preceding claims,

5 characterized

in that a continuous bit stream (bs) is converted to the ATM-oriented cell stream (zs10) and is transmitted with the aid of the ATM-oriented cell stream (zs10).

10

7. The method as claimed in claim 6,

characterized

in that the continuous bit stream (bs) is converted to the ATM-oriented cell stream (zs10)

15 in accordance with ITU-T Standard I.363.1.

8. The method as claimed in one of claims 6 or 7,

characterized

in that assembly into the original continuous bit

20 stream (bs) is carried out with the aid of the synchronization cells (sz) after transmission via the virtual connections (VC11-VC1N).

Patent Claims

1.   A method for transmitting a continuous bit stream
(bs) via an ATM communications network (KN) in
which at least two virtual connections (VC11-VC1N)
are provided, comprising the following steps:
- the continuous bit stream (bs) is converted to
an ATM-oriented cell stream (zs10), and
- the ATM-oriented cell stream (zs10) is
transmitted distributed between the virtual
connections (VC11-VC1N), with synchronization
cells (sz) being regularly inserted, at least
at times, into the virtual connections (VC11-
VC1N).

2.   The method as claimed in claim 1,
characterized
in that the synchronization cells (sz) are defined
by a synchronization cell identifier (szk) in the
header part of ATM cells.

3.   The method as claimed in one of claims 1 or 2,
characterized
in that the synchronization cells (sz) contain a
sequence number (sn).

4.   The method as claimed in one of the preceding
claims,
characterized
in that the ATM-oriented cell stream (zs10) has a
transmission bit rate which is greater than the
respective maximum transmission bit rates of the
virtual connections (VC11-VC1N).

5.   The method as claimed in one of the preceding
claims,
characterized

in that assembly into the original ATM-oriented cell stream (zs10) or the original continuous bit stream (bs) is carried out with the aid of

the synchronization cells (sz) after transmission
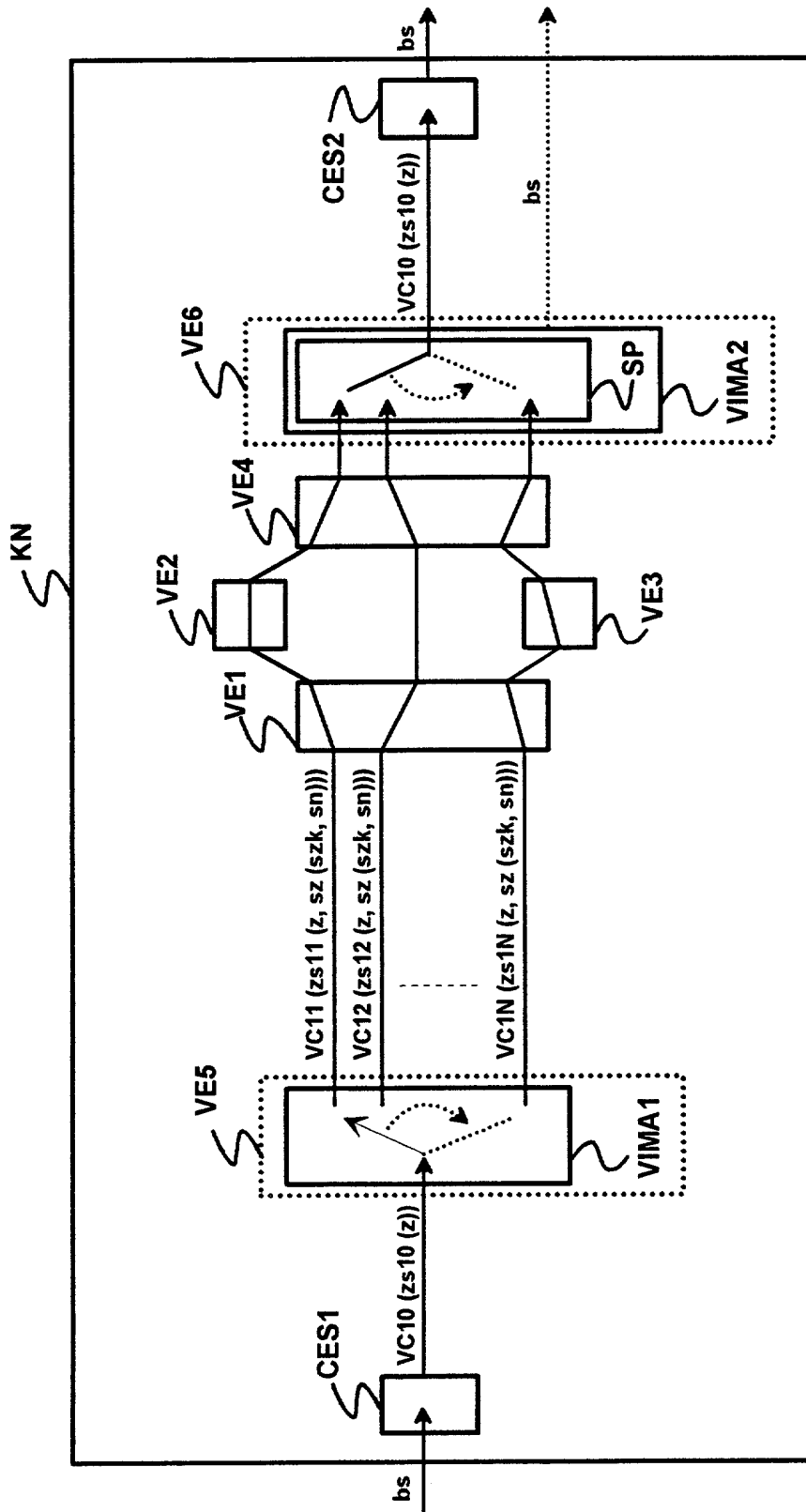via the virtual connections (VC11-VC1N).

Abstract

Method for transmitting an ATM-oriented cell stream via at least two virtual connections in an ATM communications network

The method according to the invention is used to transmit an ATM-oriented cell stream (zs10), which transmits a continuous bit stream (bs), via an ATM communications network (KN), with at least two virtual connections (VC11-VC1N) being provided in the ATM communications network (KN), between which the ATM-oriented cell stream (zs10) is distributed, and in which, at least at times, synchronization cells (sz) are regularly inserted in the virtual connections (VC11-VC1N). A high-bit-rate continuous bit stream (bs) can thus be transmitted via virtual connections (VC11-VC1N).

Figure 1

FIG 1

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications) PCT/DE99/02649	ATTORNEY'S DOCKET NUMBER 112740-143

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A METHOD FOR TRANSMITTING AN ATM-ORIENTED CELL STREAM VIA AT LEAST TWO VIRTUAL CONNECTIONS IN AN ATM COMMUNICATIONS NETWORK

the specification of which (check only one item below):

☐ is attached hereto.

☒ was filed as United States application
Serial No. ___09/763,444___

on ___February 21, 2001___

and was amended

on _____(if applicable).

☐ was filed as PCT international application

Number _____

on _____

and was amended under PCT Article 19

on _____(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Germany	198 38 420.3	24 August 1998	☒ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO

Combined Declaration For Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications) PCT/DE99/02649	ATTORNEY'S DOCKET NO. 112740-143

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject mater of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, Untied States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.

PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)		

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
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DATE 23rd of April 2001	DATE 25nd of April 2001	DATE